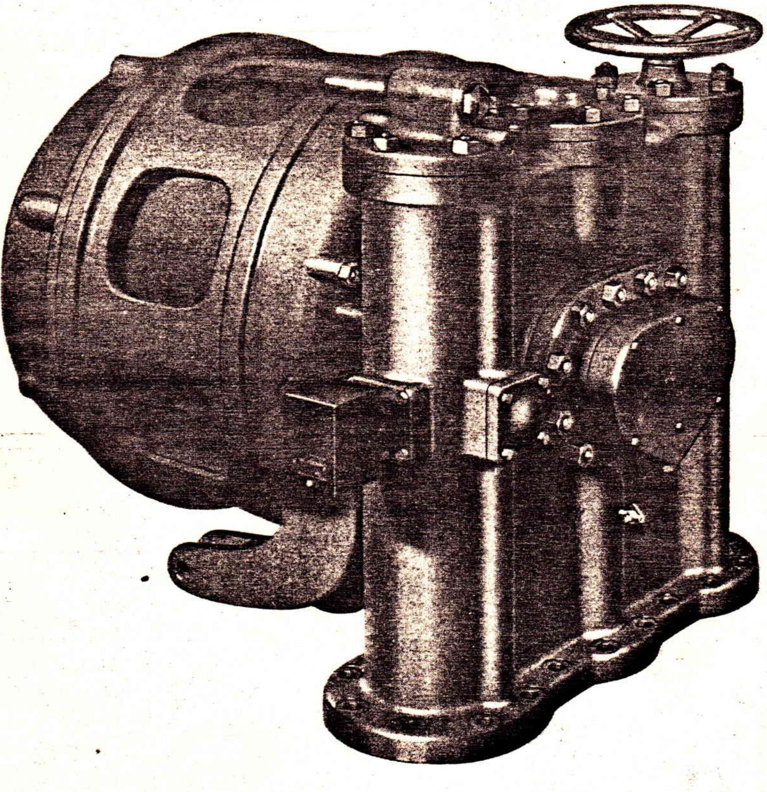
WOODWARD

# TYPE "XX"
# ROTARY GEAR OIL PUMP

BULLETIN P-2
OCTOBER, 1938



WOODWARD GOVERNOR COMPANY
ROCKFORD, ILLINOIS

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## General

The Type "XX" direct connected motor driven pump is bupilt in four basic sizes — 100, 250, 400 and 600 G.P.M. —for either 200 or 300 lbs. per square inch pressure. Intermediate capacities are obtained from the basic pumps by changing the number of teeth in the gears and changing the motor to a corresponding horsepower.

This pump is relatively small and compact and is designed to permit its application as a single unit on either a plain or sump tank type base or as one of a number operating in parallel.

## Installation

Set the pump and base in position and level with steel shims under each corner. Tighten foundation bolts and grout in place.

If the pump is supplied with plain base, make up main pressure pipe connection and suction and unloader pipe connections to the sump. The pump is self-priming and no foot or other valves are required in the suction line. Valves *must not* be used in the unloader discharge line and both suction and unloader discharge lines should be as short and straight as possible.

If the pump is furnished mounted on a sump base, suction and discharge pipes will be included and only the pressure connections must be made up.

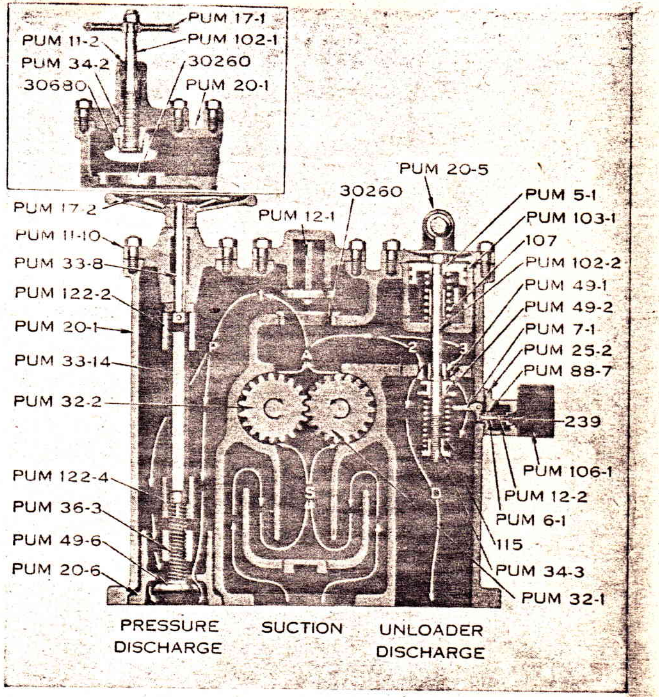
The pressure connection to the pilot valve should normally be piped directly from the pressure tank through a pressure shut-off valve.

Electrical connections should be made up in accordance with the wiring diagram mounted on the inside of the wiring cabinet door. Open the shut-off valve to the pilot valve and the main pressure valve before starting. When first starting the pump, allow it to bypass or circulate oil against no pressure for a few minutes.

## Construction

The pump consists of the following main parts:—

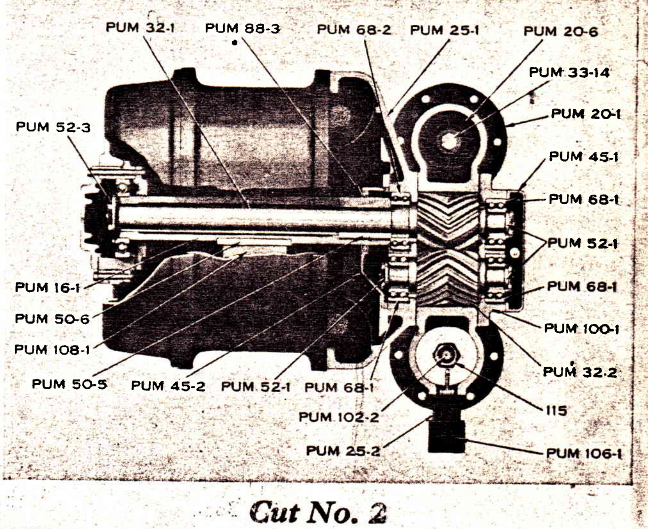
A normal-torque low starting current squirrel cage induction ball bearing motor of standard manufacture but without one end bell. The motor drives through the key PUM 50-6 (Cut No. 2) to the sleeve PUM 16-1, through the key PUM 50-5 to the shaft PUM 32-1, which is integral with the herringbone drive gear. The pump case PUM 20-1, made of semi-steel, forms a housing for the herringbone pump gears, check valve, unloader valve and pressure shut-off valve, and provides mounting for the pilot valve and pressure switch. The pilot valve pressure and discharge are piped to the pilot valve case. The pump is equipped with the manual pressure cut-off valve shown in Cut No. 1. This arrangement permits cutting off all pressure to the pump. With the valve closed, the complete pump may be removed. Some older pumps are built as shown in the inset.



Cut No. 1

PUM 5-1—Unloader Piston
PUM 6-1—Switch Push Rod
PUM 7-1—Switch Lever
PUM 11-2—Pressure Valve Bonnet (Inset)
PUM 11-10—Pressure Valve Bonnet
PUM 12-1—Check Valve
PUM 12-2—Switch Plunger
PUM 17-1—Hand Wheel (Inset)
PUM 17-2—Hand Wheel
PUM 20-1—Pump Case
PUM 20-5—Pilot Valve Case
PUM 20-6—Valve Case
PUM 25-2—Switch Bracket
PUM 32-1—Driver Gear and Shaft
PUM 32-2—Idler Gear and Shaft
PUM 33-8—Hand Wheel Shaft
PUM 33-14—Socket Shaft

PUM 34-2—Valve Disc Nut (Inset)
PUM 34-3—Unloader Stem Nut
PUM 36-3—Valve Stem
PUM 49-1—Unloader Valve Disc
PUM 49-2—Safety Valve Disc
PUM 49-6—Pressure Valve Disc
PUM 88-7—Oil Seal
PUM 102-1—Pressure Valve Stem (Inset)
PUM 102-2—Unloader Stem
PUM 103-1—Unloader Cartridge
PUM 106-1—Pressure Switch
PUM 122-2—Upper Socket
PUM 122-4—Lower Socket
107—Unloader Spring
115—Safety Spring
239—Buffer Spring
30680—Valve Disc (Inset)



Cut No. 2

PUM 16-1—Motor Shaft Sleeve
PUM 20-1—Pump Case
PUM 20-6—Valve Case
PUM 25-1—Motor Bracket
PUM 25-2—Switch Bracket
PUM 32-1—Drive Gear and Shaft
PUM 32-2—Idler Gear and Shaft
PUM 33-14—Socket Shaft
PUM 45-1—Outboard Cover Plate
PUM 45-2—Inboard Cover Plate
PUM50-5—Shaft Key
PUM-50-6—Rotor Key
PUM 52-1—Pump Bearing Retainer
PUM 52-3—Motor Bearing Retainer
PUM 68-1—Idler and Outboard Ball Bearing
PUM 68-2—Inboard Driver Ball Bearing
PUM 88-3—Oil Seal
PUM 95—Motor Stator
PUM 100-1—Bearing Plate
PUM 102-2—Unloader Stem
PUM 106-1—Pressure Switch
PUM 108-1—Rotor
115—Safety Spring
36 RX—Valve Stem
39 RX—Hand Wheel
411 K—Shut-Off Valve Seat
9-1R-100—Shut-Off Valve Body
60023—Bushing
60024—Pilot Valve Plunger
60025—Spring Case
60026—Pilot Valve Cap
60027—Spring Case Cap
60028—Adjusting Screw
81—Pilot Valve Spring

## Cycle of Operation

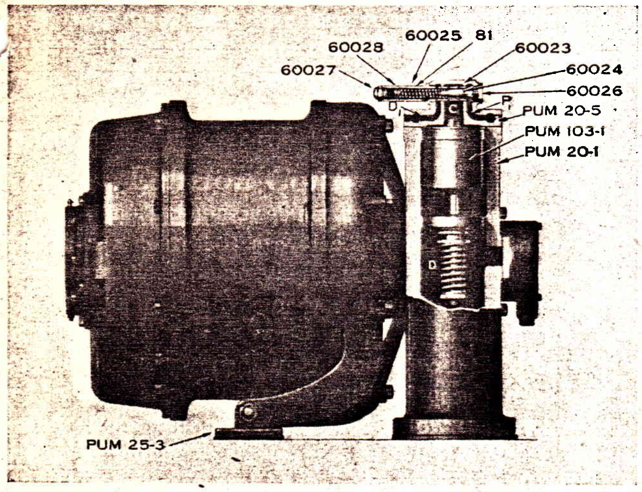
### Unloading

Oil follows arrow (1) until normal working pressure is reached in areas "P" (Cut No. 1) and "$P_1$" (Cut No. 3) which is equal to tank pressure. At this instant, the plunger No. 60024 (Cut No. 3) is forced over against the compression of spring No. 81, admitting oil from area "$P_1$" to area "C."

When pressure is admitted to area "C," piston PUM 5-1 (Cut No. 1) and stem PUM 102-2 are forced downward against the compression of spring No. 107, opening the unloader valve PUM 49-1. The check valve closes and the oil then follows arrow (2) to area "D," which is connected to the sump tank.

### Loading

When the pressure in area "P" and "$P_1$" (equal to tank pressure) reduces about 15 to 25 lbs.; the spring No. 81 will force the plunger No. 60024 toward area "$P_1$," closing off ports between "$P_1$" and "C" and opening the ports between "C" and "$D_1$". The oil in "C" will then discharge through "$D_1$," allowing spring No. 107 (Cut No. 1) to force piston PUM 5-1 and the stem PUM 102-2 upward, closing the opening between "A" and "D." The check valve will be forced upward and then the oil will follow the arrow (1) again until normal working pressure is reached.



**Cut No. 3**

PUM 20-1—Pump Case
PUM 20-5—Pilot Valve Case
PUM 25-3—Motor Foot Bracket
PUM 95—Motor Stator
PUM 103-1—Unloader Cartridge
34 RX—Gland
35 RX—Valve Bonnet

## Safety

Should the pressure rise approximately 20% above normal working pressure (due to closure of the hand valve, sticking of the pilot valve, unloader valve, or check valve, or for any other reason), the disc PUM 49-2 will be forced off its seat, and the oil from area "A" will follow arrow (3) through the holes in disc PUM 49-1 into discharge area "D."

## Pressure Switch

In most plants, normal plant regulating conditions are such that the governor pump is loaded only a small percentage of the total operating time. The greater percentage of the time it is running unloaded and doing no useful work. The purpose of this switch, therefore, is to eliminate the unnecessary waste of current and wear on the pump operating parts by stopping the pump completely during the unloaded periods. The pump is stopped automatically when the pressure in the tank reaches normal working pressure or the unloading point, and starts automatically when the pressure in the tank is reduced about 15 or 25 lbs. which is the loading point.

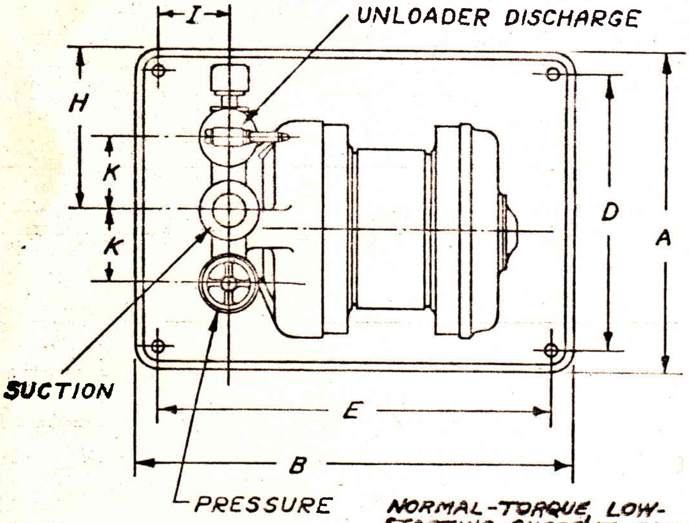
To allow "constant" operation of the pump during the occasional periods of extremely active regulation, a shunt switch is provided. If the pump is "cabinet" enclosed, the shunt switch and pilot lamp will be mounted on the front of the cabinet.

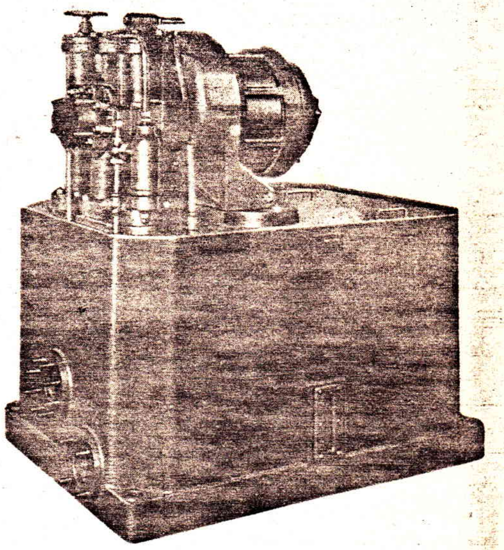
The pressure switch is so designed that the final downward movement of the unloader plunger PUM 102-2 (Cut No. 1) in unloading, causes disc PUM 49-2 to strike lever PUM 7-1 and operate switch PUM 106-1 to stop the pump motor. The initial upward movement of the unloader plunger in loading makes contact and starts the pump motor. Thus the load is relieved from the motor before the contacts are broken, and the contacts are made and the motor is up to speed before load is applied. Making and breaking the switch contacts without load on the motor adds greatly to the life of the contacts. A spring loaded plunger PUM 12-2 prevents damage of the pressure switch in case of over-travel of the unloader stem.

## Echelon Control

When two or more pumps, cabinet enclosed, are to operate in parallel, a control is provided and mounted on the cabinet to permit changing the loading and unloading point of one pump relative to that of the others. The purpose of this device is to cause one pump to do all the pumping during inactive regulating periods, with the others arranged to start operating automatically if, for any reason, the pressure drops approximately 5 lbs. below the setting of the leading pump.

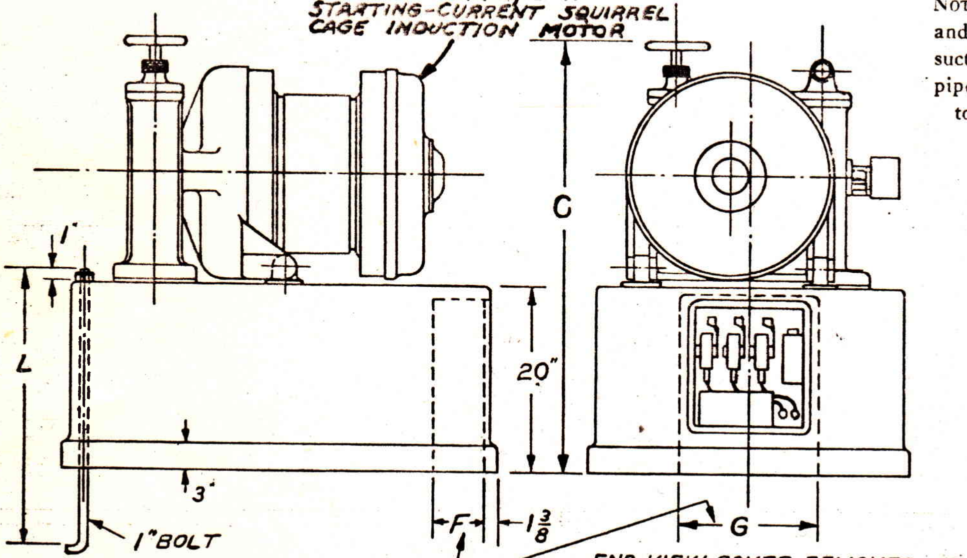
Turning the echelon control knob from LEAD to LAG decreases the tension on the pilot valve spring No. 81, thus lowering the loading point and causing the pump to lag in starting until the pressure has dropped approximately 5 lbs. below the loading point of the "leading" pump.





Type XX Pump mounted on a sump tank base.

NOTE: Sump tank base dimensions and location of pressure discharge, suction and unloader discharge pipe connections will be arranged to suit particular installation.


NORMAL-TORQUE LOW-STARTING-CURRENT SQUIRREL CAGE INDUCTION MOTOR
C
1"
L
20"
3"
1" BOLT
F
1 3/8
G
CONDUIT OPENING

END VIEW COVER REMOVED SHOWING MOUNTING OF MAGNETIC STARTER.

| Capacity Gal per Min. | Motor H.P. 200#/In.² | Motor H.P. 300#/In.² | Pipe Size | DIMENSIONS (INCHES) PLAIN BASE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | | G | | H | I | K | L |
| | | | | | | | | | 200# | 300# | 200# | 300# | | | | |
| 50 | 10 | 15 | 2½ | 36 | 42 | 46¼ | 33 | 39 | 6⅝ | 6⅝ | 11 7/16 | 11 7/16 | 18 | 2¾ | 7⅝ | 30 |
| 75 | 15 | 20 | 2½ | 36 | 42 | 46¼ | 33 | 39 | 6⅝ | 6½ | 11 7/16 | 12⅞ | 18 | 2¾ | 7⅝ | 30 |
| ★100 | 20 | 30 | 3 | 36 | 42 | 46¼ | 33 | 39 | 6½ | 6½ | 12⅞ | 12⅞ | 18 | 3½ | 7⅝ | 30 |
| 150 | 25 | 40 | 3 | 42 | 48 | 53¼ | 39 | 45 | 6½ | 11⅞ | 12⅞ | 18 5/16 | 21 | 3½ | 10¼ | 30 |
| 200 | 40 | 50 | 3½ | 42 | 48 | 53¼ | 39 | 45 | 11⅞ | 11⅞ | 18 5/16 | 18 5/16 | 21 | 4½ | 10¼ | 30 |
| ★250 | 50 | 75 | 4 | 42 | 48 | 53¼ | 39 | 45 | 11⅞ | 13⅞ | 18 5/16 | 26½ | 21 | 5¼ | 10¼ | 30 |
| 300 | 50 | 75 | 5 | 48 | 54 | 61 | 45 | 51 | 11⅞ | 13⅞ | 18 5/16 | 26½ | 24 | 6½ | 13 | 30 |
| ★400 | 75 | 100 | 5 | 48 | 54 | 61 | 45 | 51 | 13⅞ | 13⅞ | 26½ | 26½ | 24 | 6½ | 13 | 30 |
| 500 | 100 | 125 | 6 | 54 | 72 | 66 | 51 | 69 | 13⅞ | | 26½ | | 27 | 8¼ | 15 | 30 |
| ★600 | 100 | 150 | 8 | 54 | 72 | 66 | 51 | 69 | 13⅞ | | 26½ | | 27 | 11¼ | 15 | 30 |

★ Basic Pump Sizes.